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10/587,394	07/27/2006	Shuichi Ishizuka	294256US26PCT	7155
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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER				
MILLER, JR, JOSEPH ALBERT				
ART UNIT		PAPER NUMBER		
1792				
NOTIFICATION DATE		DELIVERY MODE		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/587,394

Applicant(s)

ISHIZUKA ET AL.

Examiner

JOSEPH MILLER JR

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 December 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 6-11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 12-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-20 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-8508)
Paper No(s)/Mail Date 10/27/2008
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group 1, claims 1-6 and 12-20 in the reply filed on 12/28/2008 is acknowledged.

Claim Objections

Claim 19 is objected to because of the following informalities: claim states "using plasma the nitrogen..."; this is an apparent typo and should be "using plasma of the nitrogen...". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 15 recites the limitation "the plasma" in reference to claim 12, however there are two distinct plasmas generated according to claim 12. There is insufficient antecedent basis for this limitation in the claim.

For examination purposes, "the plasma" limitation of claim 12 will be applied to each the nitrogen and oxygen plasmas.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(e) as being anticipated by Barnes (2004/0077511).

Barnes teaches a method of cleaning a process chamber using multiple plasmas (abstract). Barnes teaches a two-step cleaning process where a plasma is generated in a first step comprising oxygen gas and a hydrogen gas inclusive of NH₃ (thereby reading on instant claim 1 requirement of a plasma of a nitrogen containing gas) [0030]. The second plasma contains oxygen gas. The predetermined process in the chamber is an etch process [0002].

Claims 1 and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Law (4,960,488).

Law teaches a reactor chamber self-cleaning process (title). Law teaches a plasma chamber cleaning involving a cycle including oxygen and C₂F₆ gas (col 13, lines 17-24) followed by a chamber etch using NF₃ plasma (col 13, lines 26-35). The

predetermined process is the oxidizing process of forming silicon dioxide from TEOS (col 9, line 40- col 10, line 21).

Regarding claim 5, the process of forming silicon dioxide with oxygen present is an oxidizing process.

Claims 1, 4, 5 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Shrotriya (6,068,729).

Shrotriya teaches a process for the cleaning of a deposition chamber using a two step cleaning process (abstract). Shrotriya teaches applying, to a gas comprising oxygen in a first step including application of plasma (col 3, line 54-col 4, line 7). The second step uses a plasma which may include nitrogen gas (col 4, lines 8-23). The predetermined is a CVD process, such as the oxidation of TEOS to form silicon dioxide (col 9, lines 17-44).

Regarding claim 4, Shrotriya teaches gases comprising nitrogen and oxygen, as noted above. While instant claim 4 requires that the gas containing oxygen is oxygen gas and the gas containing nitrogen is nitrogen gas, instant claim 1 is still written as "comprising" and therefore may include additional gases beyond the "gas containing" oxygen and/or nitrogen.

Regarding claim 5, the process of forming silicon dioxide with oxygen present is an oxidizing process.

Regarding claim 19, Shrotriya teaches that the gaseous by-products are evacuated after the first cleaning step (col 4, lines 5-7).

Claims 1, 4 and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Xia (6,255,222).

Xia teaches a method for removing residue from a substrate process chamber (abstract). Xia teaches a process where a chamber is cleaned by flowing nitrogen gas into a microwave plasma system and then through the chamber, followed by replacement of the nitrogen gas with an oxygen gas (col 11, lines 51-67). The process is performed before a deposition step which is the predetermined step (col 12, lines 1-5).

Regarding claim 4, nitrogen gas and oxygen gas are both use in respective steps.

Regarding claim 5, one process where Xia's invention is applicable is for the deposition of silicon dioxide films using an organosilane with ozone (col 3, lines 35-45). This process is an oxidizing process.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Law (4,960,488) as applied to claim 1 above and in further view of Redeker (5,454,903).

Law teaches a reactor chamber self-cleaning process (title). Law teaches a plasma chamber cleaning involving a cycle including oxygen and C2F6 gas (col 13, lines 17-24) followed by a chamber etch using NF3 plasma (col 13, lines 26-35). The predetermined process is the oxidizing process of forming silicon dioxide from TEOS (col 9, line 40- col 10, line 21).

Law teaches the use of RF to generate plasma (col 3, lines 35-62), but does not teach the use of an antenna.

Redeker teaches a plasma cleaning process for a CVD chamber (title/abstract). Redeker teaches that the plasma may be generated by electrodes or by RF antenna; the antenna is shown in Figure 1 to have multiple slots (col 1, lines 44-63).

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of a multi-slotted antenna to generate plasma as taught in the plasma cleaning of a CVD chamber process of Redeker in the plasma cleaning process of Law as one could apply the use of a multi-slotted antenna with a reasonable expected of success in generating a cleaning (or process) plasma based on Redeker's successful use of an antenna generated plasma.

Claims 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shrotriya (6,068,729) as applied to claim 1 above.

Shrotriya teaches a process for the cleaning of a deposition chamber using a two step cleaning process (abstract). Shrotriya teaches applying, to a gas comprising oxygen in a first step including application of plasma (col 3, line 54-col 4, line 7). The second step uses a plasma which may include nitrogen gas (col 4, lines 8-23). The predetermined is a CVD process, such as the oxidation of TEOS to form silicon dioxide (col 9, lines 17-44).

Regarding claim 18, Shrotriya teaches the limitations of claim 1 but is silent on the length of time of either the nitrogen or oxygen containing gas cleaning cycles. It would have been obvious to someone of ordinary skill in the art at the time of the invention to optimize the cleaning process and apply each step for the length of time needed to appropriately clean the chamber, including the condition where the second process is performed for a period longer than the former operations. Additionally, the time for any given process is impacted and controlled by a number of values including but not limited to the plasma power, temperature and gas flow rates, all which are a matter of standard process optimization well known to those of ordinary skill in the art.

Regarding claim 20, Shrotriya teaches that the by-products are removed between the two cleaning steps by evacuation (col 4, lines 5-8) but does not specifically teach use of an inactive gas during the step. Examiner is taking Official Notice concerning claim 20 that the use of an inactive (or inert) gas during a chamber evacuation step was well-known to one of ordinary skill in the art at the time of the invention. The use of the inactive gas would assist in purging contents during the specifically taught evacuation step.

Claims 12, 13, 14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shrotriya (6,068,729) in view of Frankel (2002/0073922).

Shrotriya teaches a process for the cleaning of a deposition chamber using a two step cleaning process (abstract). Shrotriya teaches applying, to a gas comprising

oxygen in a first step including application of plasma (col 3, line 54-col 4, line 7). The second step uses a plasma which may include nitrogen gas (col 4, lines 8-23). The predetermined is a CVD process, such as the oxidation of TEOS to form silicon dioxide (col 9, lines 17-44; col 3, lines 55-60). (The use of TEOS and the formation of silicon oxides is taught, one of ordinary skill in the art would realize that the process of forming a silicon oxide using TEOS would involve the use of an oxidizing agent, though not specifically taught by Shrotriya).

Shrotriya teaches a cleaning process involving alternate cycles of generating a plasma of an oxygen containing gas and nitrogen containing gas before performing the predetermined silicon dioxide deposition process, but does not teach a seasoning process following the cleaning before installing the substrate.

Frankel teaches a method of performing multiple steps in-situ in the same process chamber (abstract) including the deposition of films such as undoped silicate glass [0002]. Frankel teaches the use of a pre-deposition seasoning process [0252] where TEOS and ozone are flowed to create a predeposition layer prior to the TEOS-ozone oxidizing process to form undoped silicate glass [0253].

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the preseasoning step (including the flow of an oxygen-containing gas plasma) as taught by Frankel to the precleaning plus deposition method taught by Shrotriya because it would help in reducing particle formation [0252].

(It should be noted that Frankel teaches that the seasoning step may reduce particle formation **and** F content. It would be (alternatively) possible that the F reducing

nature of the seasoning layer would be beneficial to the process of Shrotriya, because Shrotriya's process teaches "reducing or eliminating" cleaning residues (col 3, lines 18-20), thereby the seasoning process would be obvious to add to further reduce the F residues, however, the reference to Frankel is not relied upon for that reason but rather for its properties of reducing particles).

Regarding claim 13, the process performed after the cleaning and seasoning processes is an oxidizing process.

Regarding claim 14, the seasoning process taught by Frankel uses an oxygen containing gas and the process is an oxidizing process.

Regarding claim 17, Shrotriya teaches gases comprising nitrogen and oxygen, as noted above. While instant claim 4 requires that the gas containing oxygen is oxygen gas and the gas containing nitrogen is nitrogen gas, instant claim 1 is still written as "comprising" and therefore may include additional gases beyond the "gas containing" oxygen and/or nitrogen.

Claims 2 and 15 - 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shrotriya (6,068,729) as applied to claim 1 above and over Shrotriya (6,068,729) in view of Frankel (2002/0073922) as applied to claim 12 above, respectively and in further view of Nakaune (2001/0017190) and Bailey, III (2003/0047140).

Shrotriya teaches a process for the cleaning of a deposition chamber using a two step cleaning process (abstract). Shrotriya teaches applying, to a gas comprising

oxygen in a first step including application of plasma (col 3, line 54-col 4, line 7). The second step uses a plasma which may include nitrogen gas (col 4, lines 8-23). The predetermined is a CVD process, such as the oxidation of TEOS to form silicon dioxide (col 9, lines 17-44; col 3, lines 55-60). (The use of TEOS and the formation of silicon oxides is expressly taught, one of ordinary skill in the art would realize that the process of forming a silicon oxide using TEOS would involve the use of an oxidizing agent, though not specifically taught by Shrotriya).

Frankel teaches a method of performing multiple steps in-situ in the same process chamber (abstract) including the deposition of films such as undoped silicate glass [0002]. Frankel teaches the use of a pre-deposition seasoning process [0252] where TEOS and ozone are flowed to create a predeposition layer prior to the TEOS-ozone oxidizing process to form undoped silicate glass [0253].

Shrotriya in view of Frankel teaches a cleaning process involving alternate cycles of generating a plasma of an oxygen containing gas and nitrogen containing gas before performing the predetermined silicon dioxide deposition process including a seasoning process following the cleaning but does not teach the use of a plasma wherein the electron temperature is 2eV or less.

Nakaune teaches a method of using an etch gas in a semiconductor chamber [0002]. Nakaune teaches the use of an antenna to generate a plasma [0013,0014] wherein the plasma has an electron temperature of 0.25 eV to 1 eV.

Bailey teaches a method of generating plasma using an antenna [0013] and discusses the interaction of the plasma with the chamber walls [0018].

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the method of generating plasma that is between 0.25 and 1 eV using an antenna as taught by Nakaune to the cleaning, seasoning and deposition process of Shrotriya in view of Frankel as one could apply the electron temperature range taught Nakaune with a reasonable expectation of generating an etching plasma based on Nakaune's successful use of an antenna to generate plasma at an electron temperature of 0.25 to 1.0 eV. Though Shrotriya is not silent on the plasma generation method, he teaches that the cleaning process is not limited to the method discussed (col 10, lines 38-41). It is further evident from Bailey that keeping the electron low will aide in minimizing the plasma damage to the chamber walls [0018].

The plasma taught by Nakaune contains nitrogen gas [0020], however, it would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the plasma generation method to either the oxygen and/or nitrogen plasmas of Shrotriya because one would be concerned with damage to the chamber walls in either case. Though the method of Nakaune is directed to etching substrates, the teachings of Nakaune in view of Bailey would provide reason for one of ordinary skill to use a plasma with a lower electron temperature as the impact discussed is in regards to the chambers walls, which would be of great interest to one seeking to clean the chamber walls.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Li (2003/0226822) teaches that electron temperature that is typical in a high density plasma is low, on the order of a few eV [0006].

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOSEPH MILLER JR whose telephone number is (571) 270-5825. The examiner can normally be reached on Monday through Thursday from 8am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/JOSEPH MILLER JR/
Examiner, Art Unit 1792

/Timothy H Meeks/
Supervisory Patent Examiner, Art Unit 1792

